

REMARKS

In response to the Office Action dated March 26, 2008, claims 9, 12, 22, 23, 27, 28, 31, and 37 have been amended and claims 10, 11, 26, 29, and 30 have been canceled. Therefore, claims 1-9, 12-25, 27, 28, and 31-40 are now in the case. In light of the amendments and arguments set forth herein, reexamination and reconsideration of the application are requested.

Allowable Subject Matter

The Applicants gratefully acknowledge and appreciate the allowance of claims 11, 12, 18, 19, 26, 27, and 30.

The Applicants note that independent claim 9 has been amended to incorporate the subject matter of allowed claim 11 and intervening claim 10. Therefore, amended independent claim 9 contains the allowable subject matter of allowed claim 11, and is therefore also allowable. Moreover, claims 10 and 11 have been canceled, and the dependency of claim 12 has been changed to depend from claim 9 due to the cancellation of these claims.

Independent claim 23 has been amended to incorporate the subject matter of allowed claim 26. Therefore, amended independent claim 23 contains the allowable subject matter of allowed claim 26, and is therefore also allowable. Moreover, claim 26 has been canceled, and the dependency of claim 27 has been changed to depend from claim 23 due to the cancellation of claim 26.

Independent claim 28 has been amended to incorporate the subject matter of allowed claim 30 and intervening claim 29. Therefore, amended independent claim 28 contains the allowable subject matter of allowed claim 30, and is therefore also allowable. Moreover, claims 29 and 30 have been canceled, and the dependency of claim 31 has been changed to depend from claim 28 due to the cancellation of these claims.

Section 101 Rejections

The Office Action rejected claim 9 under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter. In particular, the Office Action stated that claim 9 “defines a computer-readable medium, which according to the Specification at pp. 36-37, can correspond to a data signal or carrier wave containing functional descriptive material. While functional descriptive material may be claimed as a statutory product (i.e. a ‘manufacture’) when embodied on a tangible computer readable medium, a signal *per se* does not fall within any of the four statutory classes of 35 U.S.C. § 101.”

In response, the Applicants first note that claim 9 is not a computer-readable medium claim. However, the Applicants note that claim 22 is a computer-readable medium claim that depends from independent claim 9. In the interest of furthering the prosecution of this application, in the following response the Applicants have assumed that a mistake was made and that Examiner meant to reject claim 22 and not claim 9.

Regarding claim 22, the Applicants have amended claim 22 to recite a computer-readable medium that has stored and encoded thereon functional descriptive material. Further, amended claim 22 recites structural and functional interrelationships between a computing device and a computer-readable medium that permits the computer readable medium's functionality to be realized. This is statutory subject matter.

The MPEP §2106.01 states that “[W]hen functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized.” The Applicants have amended claim 22 to recite functional descriptive material that is stored and encoded on a computer-readable medium. Again, this is statutory subject matter.

Accordingly, the Applicants respectfully submit that amended claim 22 is patentable under 35 U.S.C. § 101 based on the amendments to claim 22, and the legal and technical arguments set forth above and below. The Applicants, therefore, respectfully request

reexamination, reconsideration and withdrawal of the rejection of claim 22 under 35 U.S.C. § 101.

The Office Action rejected claims 37-40 under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter. In particular, the Office Action stated that claims 37-40 “define a system of modules embodying functional descriptive material. However, the claim does not define a computer-readable medium or memory and is thus non-statutory for that reason (i.e., ‘When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized’ – Guidelines Annex IV). That is, the scope of the presently claimed invention lacks physical structure and recites merely software modules.” Moreover, the Examiner suggested “amending the claim to embody the system of modules on a ‘computer-readable storage medium’ or equivalent in order to make the claim statutory.”

In response, the Applicants have amended independent claim 37 as suggested by the Examiner to now recite a general-purpose computing device and a computer-readable storage medium having stored and encoded thereon a computer program that contains program modules having computer-executable instructions that are executable on the computing device. The Applicants are not claiming a computer program *per se*, but a system that includes a computer program, but that is nevertheless statutory.

Specifically, as stated in the MPEP (see Section 2106 (IV)(B)(1)(a) at Page 2100-13, Rev. 2, May 2004):

“Computer programs are often recited as part of a claim. Office personnel should determine whether the computer program is being claimed as part of an otherwise statutory manufacture or machine. In such a case, the claim remains statutory irrespective of the fact that a computer program is

included in the claim. The same result occurs when a computer program is used in a computerized process where the computer executes the instructions set forth in the computer program.”

Accordingly, the Applicants respectfully submit that amended independent claim 37 is patentable under 35 U.S.C. § 101 based on the amendment to claim 37, and the legal and technical arguments set forth above and below. Moreover, claims 38-40 depend from amended independent claim 37, and thus also contain patentable subject matter (MPEP § 2143.03). The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claims 37-40 under 35 U.S.C. § 101.

Section 102(b) and Section 102(e) Rejections

The Office Action rejected claims 1-10, 13-16, 20-25, 28, and 37-40 under 35 U.S.C. § 102(b) as being anticipated by a Lu et al. (U.S. Patent No. 5,805,217). The Office Action stated that Lu et al. disclose each and every element of the rejected claims.

The Office Action rejected claims 1-11, 13-17, 20-25, 28, 29, and 31-40 under 35 U.S.C. § 102(e) as being anticipated by a Kalevo et al. (U.S. Patent No. 7,236,191). The Office Action stated that Kalevo et al. disclose each and every element of the rejected claims.

As noted above, the Applicants have amended independent claims 9, 23, and 28 to incorporate allowable subject matter of allowed claims (along with the subject matter of any intervening claims). Accordingly, the Applicants respectfully submit that amended independent claims 9, 23, and 28 are in condition for immediate allowance. Therefore, amended independent claims 9, 23, and 28 and there dependent claims will not be discussed with regard to the afore-mentioned 35 U.S.C. § 102(b) and 35 U.S.C. § 102(e) rejections.

In response to the rejection under 35 U.S.C. § 102(b) and 35 U.S.C. § 102(e) of

independent claims 1 and 37 and their dependent claims, the Applicants respectfully traverse these rejections. In general, the Applicants submit that both the Lu et al. patent and the Kalevo et al. patent are lacking several features recited in the Applicants' claims. More specifically, separately, Lu et al. and Kalevo et al. do not disclose, either explicitly or implicitly, the material claimed features of:

1. (recited in independent claim 1): “linearly combining the interpolation and the correction term to obtain a corrected interpolation of the desired color at the current pixel”; and
2. (recited in amended independent claim 37): “a linear combination module that linearly combines the interpolation and correction term to produce a corrected interpolation for the missing color value at the given pixel”.

Independent Claim 1 and Amended Independent Claim 37

Independent claim 1 recites a method for interpolating a desired color at a current pixel in a color image, where the current pixel has a current color. The method includes computing an interpolation of the desired color at the current pixel using the desired color, computing a correction term using the current color, and linearly combining the interpolation and the correction term to obtain a corrected interpolation of the desired color at the current pixel.

Amended independent claim 37 recites a gradient-corrected linear interpolation system for interpolating a missing color value at a given pixel in a color image, where the given pixel has a current color. The system includes a general-purpose computing device and a computer-readable storage medium that has stored and encoded thereon a computer program having program modules. The program modules contain computer-executable instructions that are executable by the general-purpose computing device. The computer program includes an interpolation module that computes an interpolation of the missing color value, a correction term computation module that computes a correction

term for the interpolation, and a linear combination module that linearly combines the interpolation and correction term to produce a corrected interpolation for the missing color value at the given pixel.

Note that both independent claims 1 and 37 recite **linearly** combining a interpolation and a correction term. In particular, the recited claims use “color information from a current pixel to obtain a correction term. This correction term then is linearly combined with a prior art interpolation to provide an improved estimate of a missing color at the current pixel” (specification, page 9, lines 2-5; emphasis added). The linear combination of the interpolation and the correction term yields “a corrected interpolation of the desired color at the current pixel” (specification, page 9, lines 24-26).

Moreover, the “correction term is preferably a gradient correction term computed from the current color of the current pixel” (specification, page 10, lines 1-2). “The gradient correction term is linearly combined with the interpolation . . . to improve the estimate of the desired color” (specification, page 10, lines 18-20). In addition, “prior art demosaicing techniques that do use gradients typically compute and use **complex operators** based on the gradients, such as nonlinear filters, “if” statements, and division operations. The gradient-corrected linear interpolation method simplifies computation by using a linear operation to linearly combining the gradient correction term with the interpolation” (specification, page 10, lines 20-25).

A key point about these features recited in claims 1 and 37 is that it provides interpolation of images from patterned sensors using exclusively **linear interpolation**, such that there are nonlinear operations involved. To illustrate this point, for example, look at the description on page 24, lines 9-21, of the Applicants' specification. There, the new value for G_{33} is obtained by first computing a bilinearly interpolated value G_{33B} in Step #1 (which is the bilinear interpolation), and then computing a Red gradient Δ_{33}^R , in Step #2 (which is the correction term). Next, and bilinear interpolation and the correction term are **linearly** combined (Step #3) to get the final value as $G_{33new} = G_{33B} + \alpha \Delta_{33}^R$, where α is a design parameter. For any value of α , G_{33new} can be equivalently

computed as a linear combination of G and R input values in the vicinity of pixel position “33”. The same reasoning applies to all other equations for generating interpolated values.

In other words, ultimately every interpolated value can be obtained as a linear combination of surrounding known values, in specific patterns, but no nonlinear operation is used. Namely, no non-linear operations are used, such as magnitude value computation and data-dependent change in the interpolation formulas.

Lu et al. Patent

In contrast, Lu et al. uses a non-linear combination of interpolation and correction factor. Lu et al. has the concept of first computing a linear interpolation and then applying a correction factor, but the correction is not linear. More specifically, in the equations in Lu et al. in Column 7, lines 15 to 20 (for computing XR), and Column 7, lines 20 to 25 (for computing YR), it appears that the interpolated values are computed using linear equations. However, the whole interpolation process is not linear. In particular, looking into the equations at the bottom of Column 6, lines 61-67, it can be seen that we see that the gradients ΔXG and ΔYG are computed nonlinearly, because absolute-value (modulus) operators $|\cdot|$ are used. Then, data-dependent decision making is used by selecting the interpolated value between XR or YR depending on the values of ΔXG and ΔYG . Therefore, the technique of Lu et al. is nonlinear for two reasons: (1) non-linear modulus operators are employed; and (2) data-dependent decisions are made between two linear operators.

The Office Action stated that Lu et al. teach linearly combining the interpolation and the correction term at Column 5, lines 55-60, where the first term is added to the second term. However, in this equation both the first and the second terms together are the interpolation term for a Green value. In particular, the Green value is made up of Green intensity values (the first term) and Blue intensity values (the second term). As explained above, the interpolation term in Lu et al. then is non-linearly combined with a correction term.

Accordingly, the Applicants respectfully submit that independent claim 1 and amended independent claim 37 are patentable under 35 U.S.C. § 102(b) and are not anticipated by Lu et al., based on the amendments to claim 37, and the legal and technical arguments set forth above and below. Moreover, claims 2-8 depend from independent claim 1, and claims 38-40 depend from amended independent claim 37, and also are patentable over Lu et al. (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claims 1-9, 10, 13-16, 20-25, 28, and 37-40 under 35 U.S.C. § 102(b) as being anticipated by Lu et al.

Kalevo et al. Patent

In contrast, Kalevo et al. also uses a non-linear combination of interpolation and correction factor. Specifically, in the description of the interpolation technique in Kalevo et al. in Column 4, lines 1-20, it can be seen that the absolute values of pixel differences are computed. Next, in Column 4, lines 21-29, these absolute values of pixel differences are used to select interpolation directions. Different interpolation formulas are used depending on the direction selected (see Column 4, lines 30-49). Again, the technique of Kalevo et al. is nonlinear for two reasons: (1) non-linear modulus operators are employed; and (2) data-dependent decisions are made between two interpolation formulas.

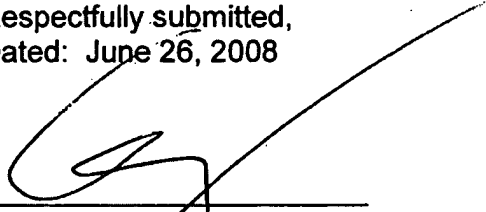
Accordingly, the Applicants respectfully submit that independent claim 1 and amended independent claim 37 are patentable under 35 U.S.C. § 102(e) and are not anticipated by Kalevo et al., based on the amendments to claim 37, and the legal and technical arguments set forth above and below. Moreover, claims 2-8 depend from independent claim 1, and claims 38-40 depend from amended independent claim 37, and also are patentable over Kalevo et al. (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claims 1-11, 13-17, 20-25, 28, 29, and 31-40 under 35 U.S.C. § 102(e) as being anticipated by Kalevo et al.

Conclusion

In view of the amendments to claims 9, 12, 22, 23, 27, 28, 31, and 37, and the arguments set forth above, the Applicants submit that pending claims 1-9, 12-25, 27, 28, and 31-40 are in condition for immediate allowance. The Examiner, therefore, is respectfully requested to withdraw the outstanding rejections of the claims and to pass each of the pending claims of this application to issue.

In an effort to expedite and further the prosecution of the subject application, the Applicants kindly invite the Examiner to telephone the Applicants' attorney at (805) 278-8855 if the Examiner has any comments, questions or concerns, wishes to discuss any aspect of the prosecution of this application, or desires any degree of clarification of this response.

Respectfully submitted,
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